Patent claims

1. Monitoring method for an actuator (CP), especially for a piezoelectric actuator (CP) of an injection valve of an internal combustion engine, with the following steps: - measurement of the electrical current (i_{R1}) flowing in an actuator circuit through the actuator (CP),

- measurement of the electrical current (i_{R3}) flowing in the actuator circuit before or after the actuator (CP),
- comparison of the two measured currents (i_{R1}, i_{R3}) for detection of a fault and
- generation of a diagnostic signal (DIAG) indicating the fault as a function of the comparison,

characterized in that,
the diagnostic signal (DIAG), to distinguish between an earth short circuit, a voltage short circuit and an error-free state, takes on at least three different values depending on the comparison of the measured currents.

2. Monitoring method in accordance with claim 1, characterized in that,
the diagnostic signal (DIAG) to distinguish between a voltage short circuit to a first voltage and a voltage short circuit to a second voltage takes on at least four different values depending on the comparison of the two measured currents (I_{R1}, I_{R3}).

3. Monitoring method in accordance with claim 1 and/or claim 2,
characterized in that,
the electrical voltage (U_{C2}) is measured in the actuator circuit and the diagnostic signal (DIAG) is generated depending on the measured voltage (U_{C2}).

4. Monitoring method in accordance with claim 3,

characterized in that, the voltage increase is determined and the diagnostic signal (DIAG) generated depending on the measured voltage increase.

5. Monitoring method according to claim 3, characterized in that, the voltage (U_{C2}) is measured during a charging process and the diagnostic signal (DIAG) is generated depending on the measured voltage (U_{C2}).

6. Monitoring method according to claim 3, characterized in that, the voltage (U_{C2}) is measured between a charging process and a discharging process and the diagnostic signal (DIAG) is generated depending on the measured voltage (U_{C2}).

7. Monitoring method according to at least one of the previous claims, characterized in that, the current (i_{R1}, i_{R2}) flowing in the actuator circuit is measured at two earth-side measuring points.

8. Monitoring method according to at least one of the claims 1 to 6, characterized in that, the current (i_{R1}, i_{R2}) flowing in the actuator circuit is measured at two voltage-side measuring points.

9. Monitoring method according to at least one of the claims 1 to 6, characterized in that, the current (i_{R1}, i_{R2}) flowing in the actuator circuit is measured at one earth-side measuring point and at one voltage-side measuring point.

10. Driver circuit for an actuator (CP), especially for a

piezoelectric actuator (CP) for an injection valve of an internal combustion engine, with

an actuator circuit for charging and discharging the actuator (CP) arranged in the actuator circuit,

a first measuring device (R1, 4) for measuring the electrical current (i_{R1}) flowing through the actuator (CP),

a second measuring device (R3, 4) for measuring the electrical current (i_{R3}) flowing in the actuator circuit before or after the actuator (CP),

a comparator unit (4) for comparing the two measured electrical currents (I_{R1}, I_{R3}) and for generating a diagnostic signal (DIAG) depending on the comparison,

characterized in that

the diagnostic signal (DIAG), to distinguish between an earth short circuit, a voltage short circuit and an error-free state, takes on at least three different possible values, depending on the comparison of the measured currents (i_{R1}, i_{R3}).

11. Driver circuit according to claim 10, characterized by a transformer (3) with a primary winding (W1) and a secondary winding (W2), with the secondary winding (W2) being arranged in the actuator circuit,

12. Driver circuit according to claim 10 and/or claim 11, characterized in that, the actuator circuit features a first circuit branch (S3, R4) and a parallel second circuit branch (D3, R3), with the first circuit branch (S3, R4) containing a discharge switch (S3) and carrying the electrical current during of the discharging process,

while the second circuit branch (D3, R3) contains a diode (D3) and carries the electrical current during of the charging process.

13. Driver circuit according to at least one of the claims 10 to 12,
characterized in that,
the first measuring device features a first measurement resistor (R1) which is connected in series with the actuator (CP).

14. Driver circuit according to at least one of the claims 10 to 13,
characterized in that,
the second measuring device features a second measurement resistor (R3) which is connected in series with the secondary winding (W2) of the transformer (3).

15. Driver circuit according to claim 14,
characterized in that,
the second measurement resistor (R3) is arranged in the second circuit branch (D3, R3).

16. Driver circuit according to at least one of the claims 10 to 15,
characterized by
a third measuring device (C2, 4) for measuring the electrical voltage (U_{C2}) arising during of the charging process in the actuator circuit, with the third measuring device being connected to the comparator unit (4) to generate the diagnostic signal (DIAG) depending on the measured voltage (U_{C2}).

17. Driver circuit according to at least one of the claims 10 to 16,

characterized in that, the first measuring device (R1, 4) and the second measuring device (R3, 4) are arranged on the earth side of the actuator circuit.

18. Driver circuit according to at least one of the claims 10 to 17, characterized in that, the first measuring device and the second measuring device are arranged on the voltage side of the actuator circuit.

19. Driver circuit according to at least one of the claims 10 to 17, characterized in that, one of the two measuring devices is arranged on the earth side while the other measuring device is arranged on the voltage side.

20. Driver circuit according to at least one of the claims 10 to 19, characterized in that, the first measuring device (R1, 4) and/or the second measuring device (R3, 4) are decoupled from the circuit input.